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### (54) OPEN-TYPE HEADPHONE

#### (57)Abstract:

PROBLEM TO BE SOLVED: To secure satisfactory low-frequency sounds, without raising the middle and high-band levels by preparing an acoustic equalizer at the front part of an acoustic unit which converts the audio signals into sounds and correcting the characteristic of the acoustic waves which are outputted from the acoustic unit. SOLUTION: An acoustic unit 1 contains a permanent magnet 12, and a center pole 13 at the center of a yoke 11 and constructs a magnetic circuit. A voice coil, wound round a bobbin 14, is added to the magnetic circuit. Then a cone 15 is added to the bobbin 14, and also the audio signals are supplied to the voice coil. Thus, the cone 15 is driven and the acoustic waves are outputted. A protective plate is placed in front of the cone 15 and have many through-holes, so as not to disturb the acoustic waves which are sent from the cone 15. Furthermore, an acoustic equalizer 5 is placed at the front part of the unit 1 and has a cylindrical housing 51 one of whose both faces is opened.

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## CLAIMS

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[Claim(s)]

[Claim 1] The open sand mold headphone which have the sound unit which changes an audio signal into sound, and the sound equalizer which amends the frequency characteristics of the acoustic wave which is formed in the anterior part of the above-mentioned sound unit, and is outputted from this sound unit.

[Claim 2] The open sand mold headphone which have a year pad and the supporter material which holds the above-mentioned sound unit at predetermined spacing to the handle part of a listener in open sand mold headphone according to claim 1.

[Claim 3] In open sand mold headphone according to claim 1 the above-mentioned sound equalizer It is constituted by the box of the shape of a cup which has the predetermined volume, and opening of this box is opposite-\*(ed) by the above-mentioned sound unit. spacing of the above-mentioned opposed face and the volume of the above-mentioned box -- low-pass [ of the above-mentioned frequency characteristics ], and the crown -- the open sand mold headphone by which amendment with a region was made to be performed. [ as opposed to / the bore which makes an opposed face with the above-mentioned sound unit of the above-mentioned box pass the acoustic wave from the above-mentioned sound unit is formed, and / the handle part of the above-mentioned listener ]

[Claim 4] They are the open sand mold headphone which prepared ventilation resistance in this another bore while the above-mentioned box had another bore in open sand mold headphone according to claim 3.

[Claim 5] The open sand mold headphone by which the amendment of a high region of

the above-mentioned frequency characteristics was made to be performed in open sand mold headphone according to claim 4 by the above-mentioned bore formed in the above-mentioned box.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to open sand mold headphone.

[0002]

[Description of the Prior Art] As shown in drawing 5 A-C, the headphone of the type with which it is covered on the head among dynamic-type headphone, i.e., the headphone of an outer year mold, can be divided roughly into closed mold, an opening air mold, and an open sand mold (full open type).

[0003] That is, although each drawing 5 shows the headphone unit of a piece channel, as the headphone of closed mold are shown in drawing 5 A, while the year pad 2 is formed in the anterior part of the electromagnetic sound unit 1, the posterior part is sealed with housing 3.

[0004] In this case, although the sound unit 1 does not carry out illustration, it is constituted almost like the loudspeaker of a general dynamic type, while the coil with which the cone (diaphragm) was attached into the field by the permanent magnet is prepared, an audio signal is supplied to this coil and that audio signal is changed into sound. Moreover, the year pad 2 is prepared in the perimeter of the anterior part of the sound unit 1, and is using between the sound unit 1 and the handle parts EAR of a listener as the air space sealed mostly while it is constituted in the shape of a ring by the member which has insulation comparatively.

[0005] And in the headphone of this closed mold, since the anterior part and the posterior part of the sound unit 1 are sealed, while braking to the cone of the sound unit 1 is strong and can obtain sufficient bass, it can consider as the good bass of damping.

[0006] Moreover, as the headphone of an opening air mold are shown in drawing 5 B, while the year pad 2 is formed in the anterior part of the sound unit 1, the year pad 2 shall have suitable permeability. Moreover, predetermined bore 3A is formed in housing 3.

[0007] Therefore, since the anterior part and the posterior part of the sound unit 1 will be wide opened outside through suitable acoustic resistance, they can obtain suitable sealing nature and suitable braking, and can obtain bass with good and moderate damping too as a result.

[0008] Furthermore, as the headphone of an open sand mold are shown in drawing 5 C, the ear pad 2 and housing 3 are not formed. And the sound unit 1 separates from a handle part EAR by supporter material (not shown), and is arranged.

[0009] Therefore, in the headphone of this open sand mold, since there is neither the ear pad 2 nor housing 3, it excels in the spaciousness about the sound outputted, and that evaluation is high. Moreover, since a handle part EAR is not steamed with sweat even if it uses it over long duration while there are few feelings of oppression over a handle part EAR, the evaluation attached in the merit of a feeling of wearing or a feeling of use is also high.

[0010]

[Problem(s) to be Solved by the Invention] However, in the headphone of an open sand mold, since the air space between the sound unit 1 and a handle part EAR is not isolated from the exterior like closed mold or an opening air mold, the bass outputted from the sound unit 1 escapes outside, and there is an inclination for bass to run short for a listener.

[0011] Then, it can consider making the sound unit 1 approach a handle part EAR. That is, since loud sound 5kHz or more generally has directivity if it is less than diameter extent of the cone of the sound unit 1 even if spacing of the sound unit 1 and a handle part EAR changes, the level of the loud sound seen from the listener hardly changes.

[0012] However, since the acoustic wave which escapes outside through the opening between the sound unit 1 and a handle part EAR about bass as the sound unit 1 approaches a handle part EAR decreases, the level of the bass seen from the listener rises.

[0013] Therefore, sufficient bass can be obtained by making the sound unit 1 approach a handle part EAR.

[0014] Drawing 4 shows the example of measurement of the frequency characteristics (output sound pressure frequency characteristics) of the sound unit 1, and the frequency characteristics in the case of being separated from Curve D of the sound unit 1 and the handle part EAR and Curve N are frequency characteristics when both are approaching. And if the sound unit 1 is brought close to a handle part EAR so that clearly also from this measurement result, sufficient bass will be obtained and the thing of it can be carried out.

[0015] however, at this time, when the level of bass is improved by bringing the sound unit 1 close to a handle part EAR as mentioned above, even if it compares Curve D and Curve N of drawing 4, it understands -- as -- the crown -- the level of a region will rise. the inertance of the path to which this results outside through the volume between the sound unit 1 and a handle part EAR, and the opening of these between -- the crown -- it is for producing resonance in a region.

[0016] and -- such -- the crown -- if the level of a region rises, it will become unpleasant tone quality on audibility.

[0017] in this case -- if it is the headphone of an opening air form, \*\*\*\*\* it will produce the above-mentioned resonance -- the ventilation resistance of the year pad 2 -- that resonance -- Q discharge -- it can carry out -- therefore, the crown -- the rise of the level of a region can be suppressed.

[0018] however -- since there is no year pad 2 in the headphone of an open sand mold -- the crown -- if resonance is produced in a region, Q discharge of this cannot be done and the level cannot be stopped.

[0019] the points with this above invention -- taking an example -- the headphone of an open sand mold -- setting -- the crown -- sufficient bass is obtained, without raising the level of a region.

[0020]

[Means for Solving the Problem] In this invention, it is prepared in the anterior part of the sound unit which changes an audio signal into sound, and the above-mentioned sound unit, and considers as the open sand mold headphone which have the sound equalizer which amends the frequency characteristics of the acoustic wave outputted from this sound unit. Therefore, frequency characteristics are amended by the sound equalizer and, as for the acoustic wave outputted from the sound unit, the good frequency characteristics of balance are realized.

[0021]

[Embodiment of the Invention] Although drawing 1 shows the headphone unit of the piece channel of the open sand mold headphone by this invention, as the sound unit 1 explained in drawing 5 , it is constituted by electromagnetic.

[0022] That is, in the sound unit 1, while a permanent magnet 12 and a senter pole 13 are formed in the center in York 11 and a magnetic circuit is constituted, the voice coil (not shown) wound around the bobbin 14 in this magnetic circuit is arranged. And while a cone 15 is formed in a bobbin 14, an audio signal is supplied to the voice coil, a cone 15 drives, and an acoustic wave is outputted.

[0023] Moreover, a guard plate 16 is formed ahead of a cone 15. In addition, many bores are formed in this guard plate 16 so that this may not serve as a failure of the acoustic wave from a cone 15.

[0024] Furthermore, the sound equalizer 5 is formed in the anterior part of the sound unit 1. This sound equalizer 5 has the cylinder-like box 51 with which one field was used as opening, as shown also in drawing 2 . In this case, this box 51 has the predetermined volume, and that opening is made almost equal to the outer diameter of the sound unit 1, and it is prepared so that that opening may plug up the front face of the sound unit 1.

[0025] And among boxes 51, while the bore 52 of predetermined magnitude which passes the acoustic wave from a cone 15 is formed with a cone 51 in the field which counters, the bore 53 of predetermined magnitude is formed also in this field and peripheral surface. Moreover, the material 54 which gives predetermined resistance to the acoustic wave which is going to pass this, for example, a nonwoven fabric, is

formed in the bore 53. In addition, the diameter of a bore 52 is 40mm or less.

[0026] Furthermore, as supporter material which supports this, while the spoke 4 of the shape of two or more rod is formed, the year pad 2 is formed in the edge, and to the handle part EAR of a listener, at the time of use of headphone, the sound unit 1 approaches at the predetermined spacing, and is supported by the sound unit 1 at it. Moreover, in this example, the posterior part of the sound unit 1 is sealed with housing 3.

[0027] In addition, although illustration is not carried out, such a headphone unit is prepared for the left and two right channels, and between the headphone unit of these left channel and the headphone of a right channel is connected with a head strap.

[0028] And as shown in drawing 1 , when the head of a listener is equipped with these headphone, the year pad 2 is located in the perimeter of a handle part EAR, and the sound equalizer 5 has predetermined spacing to a handle part EAR, and he is trying to counter.

[0029] Since the nonwoven fabric 54 is formed in the bore 52 of a box 51 according to such a configuration, the acoustic wave from a cone 15 reaches a handle part EAR mainly through a bore 52, and can hear this.

[0030] And this is equivalent to the sound unit 1 (cone 15) having approached the handle part EAR, and since the acoustic wave from a cone 15 is outputted to the exterior of a box 51 mainly through a bore 52 in that case, and it concentrates from a bore 21 and is moreover outputted, a listener can hear sufficient bass.

[0031] moreover, the thing for which the volume of a box 51 is made into predetermined magnitude although later mentioned for details at this time -- the crown of the acoustic wave from a cone 15 -- the frequency characteristics seen from the listener since the region declined -- the crown -- the rise of a region is suppressed.

[0032] therefore -- according to the headphone of drawing 1 -- bass -- rich -- the crown -- a straight playback sound can be asked to a region. And the features of open sand mold headphone are not spoiled in that case.

[0033] Drawing 3 simplifies and shows the sound equal circuit of the headphone of drawing 1 , and is shown by the source VO of a signal where the sound unit 1 outputs an acoustic wave, and the series resonant circuit Z0 which gives lowest resonance frequency  $f_0$ . Moreover, the acoustic circuit ZB of posterior parts, such as housing 3, is connected to the sound unit 1.

[0034] Furthermore, although the sound equalizer 5 is connected to the sound unit 1, in this sound equalizer 5, capacity CE shows the volume of a box 51, Resistance RE shows a nonwoven fabric 54, and Inertance ME shows a bore 52.

[0035] Moreover, capacity CL shows the volume of the air space between the sound equalizer 5 and a handle part EAR, and a path in case Inertance ML escapes to the opening between the sound equalizer 5 and a handle part EAR and an acoustic wave escapes to the exterior is shown. And the acoustic wave shown on an electrical

potential difference VL is supplied to a handle part EAR.

[0036] Therefore, since the sound unit 1 is close to a handle part EAR while being outputted as it is through Inertance ME, the bass outputted from the sound unit 1 reaches a handle part EAR on sufficient level.

[0037] moreover, the crown outputted from the sound unit 1 -- the crown supplied to a handle part EAR since a region is bypassed through capacity CE and Resistance RE before it results in the air space between the sound equalizer 5 and a handle part EAR -- the big peak is suppressed in the region.

[0038] Furthermore, although it omits since the high region outputted from the sound unit 1 is difficult to become a three-dimension-distributed constant circuit and to express in an equal circuit for radiation, level seldom changes for [ of the sound unit 1 ] directivity.

[0039] However, if the path of the bore 52 for \*\*\*\* is made small, the level of a high region supplied to a handle part EAR by Inertance ME becomes small, namely, the level of a high region can be adjusted.

[0040] In drawing 4 , Curve E shows the measurement result of the frequency characteristics of the headphone of drawing 1 , and the sound unit 1 of it is the same as that of the case of Curves D and N. and according to this measurement result, bass improves on sufficient level -- having -- moreover, the crown -- the peak of a region is also fully suppressed and serves as the good property of balance as a whole.  
[0041]

[Effect of the Invention] according to this invention -- open sand mold headphone -- setting -- the bass of sufficient level -- it can obtain -- moreover -- the crown -- it can consider as the gentle property which does not have a peak in a region.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing one gestalt of this invention.

[Drawing 2] It is the perspective view showing a part of one gestalt of this invention.

[Drawing 3] It is the sound equal circuit of the headphone by this invention.

[Drawing 4] It is a property Fig. for explaining this invention.

[Drawing 5] It is a sectional view for explaining headphone.

[Description of Notations]

1 [ -- A spoke, 5 / -- A sound equalizer, 11 / -- York, 12 / -- A permanent magnet, 13 / -- Pole piece, 14 / -- A bobbin, 15 / -- A cone, 16 / -- A guard plate, 51 / -- A box, 52 / -- The bore for \*\*\*\*, 53 / -- The bore for aeration, 54 / -- Nonwoven fabric ] -- A sound unit, 2 -- A year pad, 3 -- Housing, 4



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